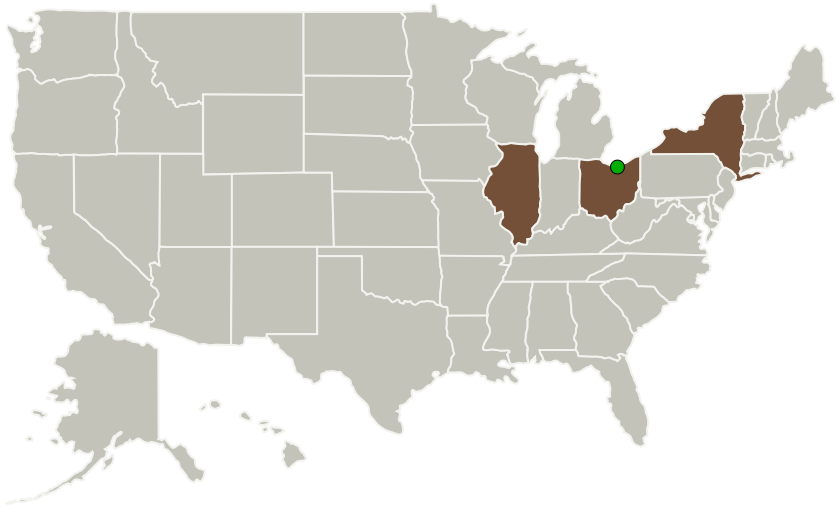
Advanced Epitaxial Lift-Off Quantum Dot Photovoltaic Devices, Phase I

Completed Technology Project (2012 - 2013)

Project Introduction

We propose to develop a high-efficiency, triple-junction, epitaxial lift-off (ELO) solar cell by incorporating quantum dots (QDs) within the current-limiting subcell. We intend to leverage existing QD epitaxy processes developed by the Rochester Institute of Technology and combine this with MicroLink's expertise in multi-junction cell growth and ELO technology. We will employ QDs to enhance the middle cell absorption in a InGaP/GaAs/InGaAs metamorphic IMM cell. Detailed balance calculations indicate that the triple junction efficiency can be increased to ~42% by reducing the bandgap of the middle cell to ~1.2 eV. The combination of the QD technology with multi-junction ELO technology will be exploited in two ways: i) ELO GaAs cells with QD can be grown into full triple-junction cells and ii) back-surface reflectors on the ELO cells will be used to improve absorption by routing IR light for a second pass through the QD subcell. The relevance of this work to NASA is that it will result in lightweight, high-efficiency, triple-junction solar cells that will have a specific power > 500 W/kg. In addition, the use of QDs has been shown to improve radiation tolerance of the photovoltaic device.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
MicroLink Devices, Inc.	Lead Organization	Industry Minority-Owned Business	Niles, Illinois
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
Rochester Institute of Technology(RIT)	Supporting Organization	Academia	Rochester, New York

Primary U.S. Work Locations	
Illinois	New York
Ohio	

Project Transitions

February 2012: Project Start

February 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137957)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

MicroLink Devices, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

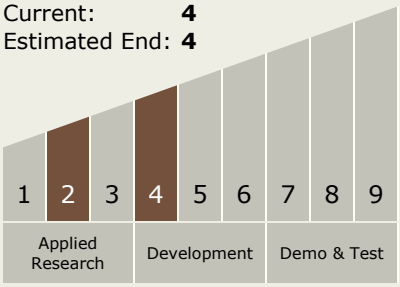
Carlos Torrez

Principal Investigator:

Sudersena Rao Tatavarti Bharatam

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.1 Photovoltaic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System